

Another Brick in the Wall: Comparing 3D Robotic Bricklaying Technologies and Business Models

Tugce Uslu
Research Associate

Materials
June 1, 2017



lux executive summit

Amsterdam • May 31 - June 1, 2017

New design and manufacturing tools are influencing various industries and tasks including bricklaying

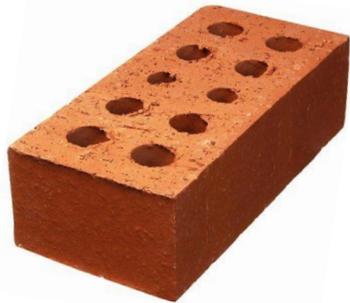


Image credits: pinterest, dailymail, construction enquirer

New design and manufacturing tools are influencing various industries and tasks including bricklaying

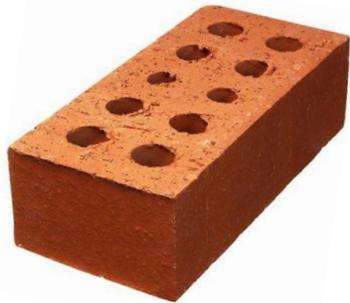
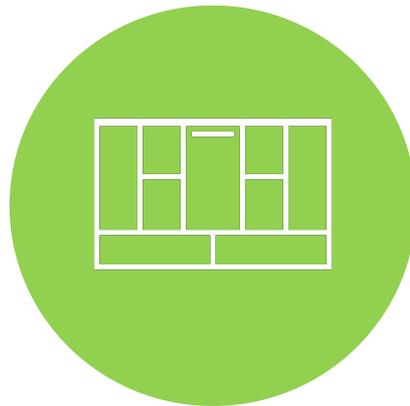
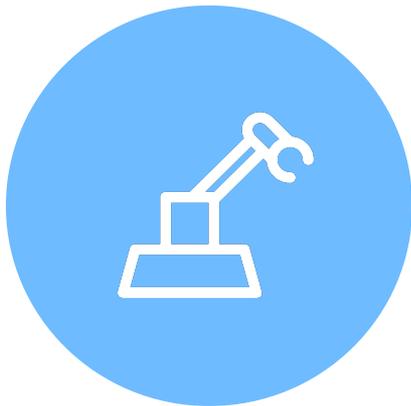


Image credit: [Bloomberg](#)

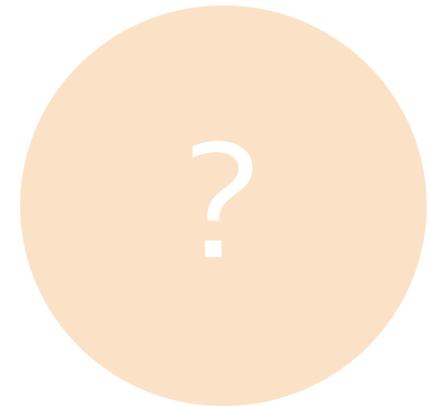
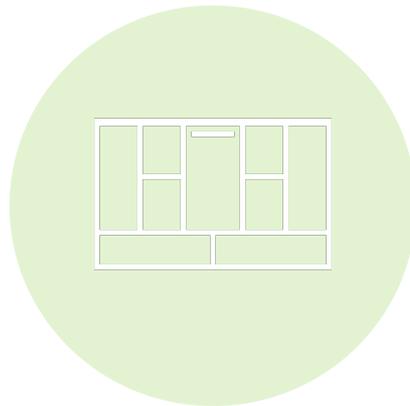
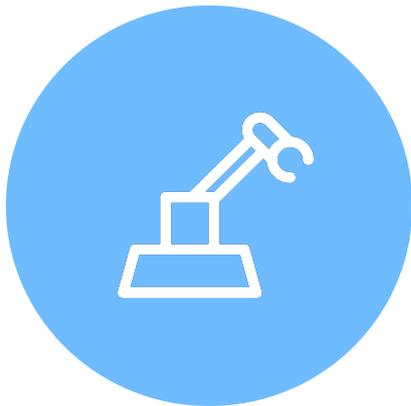
Agenda

- › The 3D robotic bricklaying technologies and business models
- › The effect of these models on value chains
- › Lessons for material commercialization opportunities and key takeaways



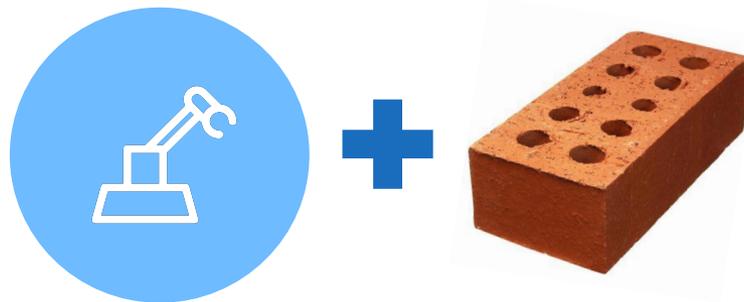
Agenda

- › The 3D robotic bricklaying technologies and business models
- › The effect of these models on value chains
- › Lessons for material commercialization opportunities and key takeaways

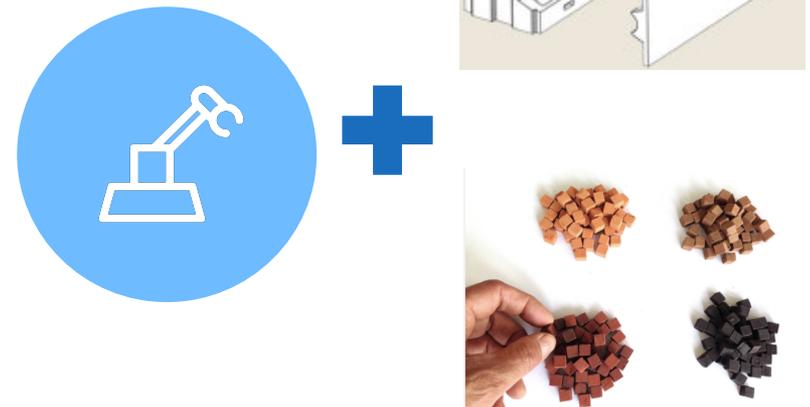


There are a few start-ups automating bricklaying with two approaches

Approach 1



Approach 2

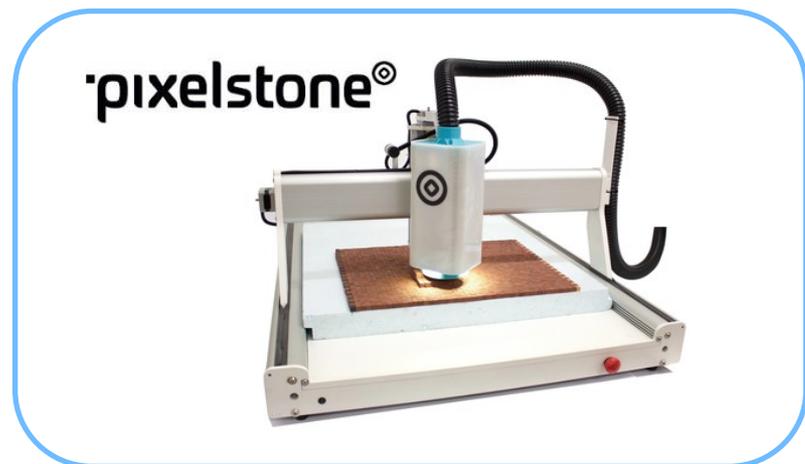
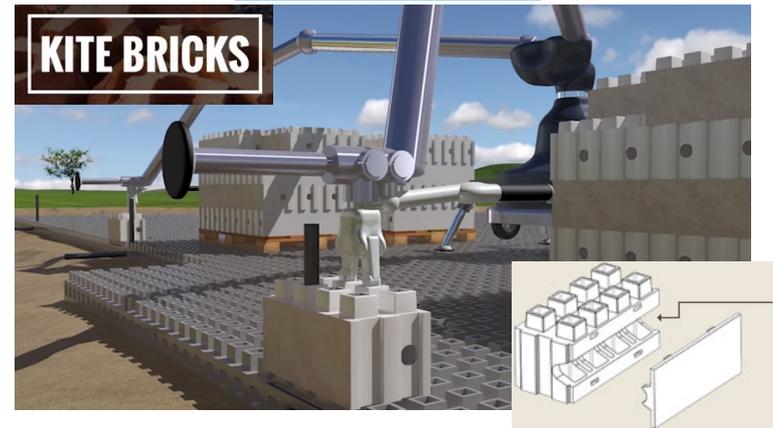


There are a few start-ups automating bricklaying with two approaches

Approach 1



Approach 2



Fastbrick Robotics

3D automated bricklaying system for building construction

› Technology and Differentiators

- › Automated loading, cutting, routing and placement of bricks, and special adhesive application to build walls



Case Study 1



Summary information

<i>Founded in</i>	2006
<i>Location</i>	Australia
<i>Employees</i>	11
<i>Revenue*</i>	\$0

* As of June 2016

Fastbrick Robotics

3D automated bricklaying system for building construction

› Technology and Differentiators

- › Automated loading, cutting, routing and placement of bricks, and special adhesive application to build walls
- › Laser tracker and alignment system for accuracy



Case Study 1



Summary information

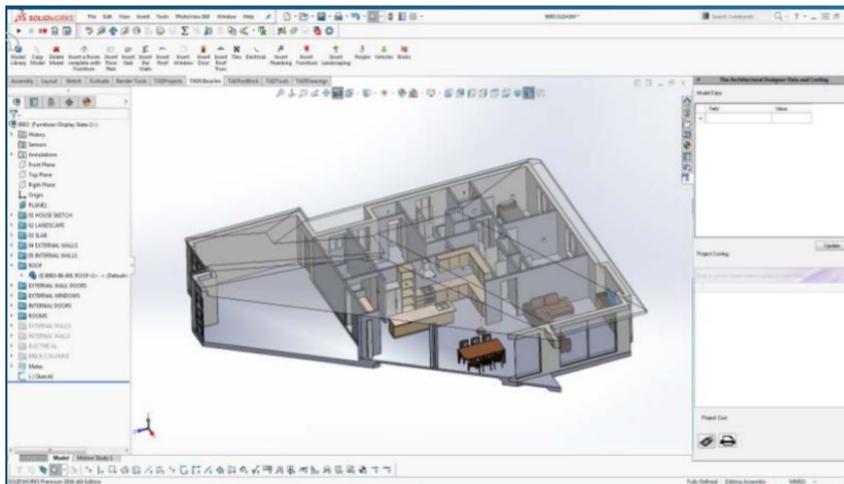
<i>Founded in</i>	2006
<i>Location</i>	Australia
<i>Employees</i>	11
<i>Revenue*</i>	\$0
* As of June 2016	

Fastbrick Robotics

3D automated bricklaying system for building construction

› Technology and Differentiators

- › Automated loading, cutting, routing and placement of bricks, and special adhesive application to build walls
- › Laser tracker and alignment system for accuracy
- › Proprietary TAD software to design, and help control laying data



Case Study 1



Summary information

<i>Founded in</i>	2006
<i>Location</i>	Australia
<i>Employees</i>	11
<i>Revenue*</i>	\$0

* As of June 2016

Fastbrick Robotics

3D automated bricklaying system for building construction

› Technology and Differentiators

- › Automated loading, cutting, routing and placement of bricks, and special adhesive application to build walls
- › Laser tracker and alignment system for accuracy
- › Proprietary TAD software to design, and help control laying data



Case Study 1



Summary information

<i>Founded in</i>	2006
<i>Location</i>	Australia
<i>Employees</i>	11
<i>Revenue*</i>	\$0

* As of June 2016

Fastbrick Robotics

3D automated bricklaying system for building construction

Case Study 1

› Strategy and Markets

- › Plans to lease machines to construction companies; license technology to large machine manufacturers, or sell to leasing companies
- › Price: \$2 million/machine

› Lux Take

- › Remains pre-revenue; the specific value proposition and the customer has not yet been fully validated through sales

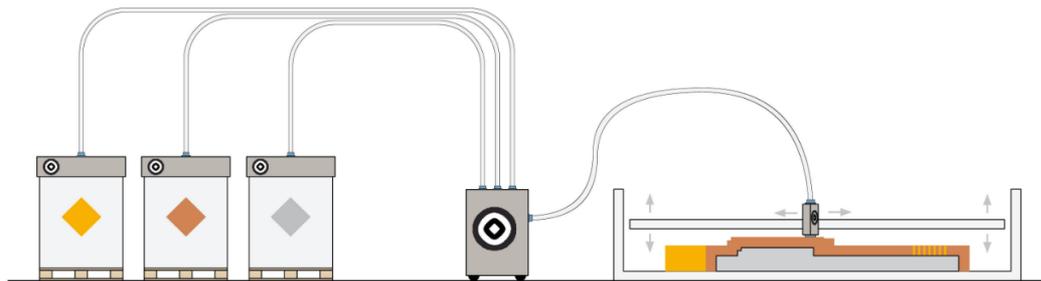


Pixelstone

Automated brick façade manufacturing system

› Technology and Differentiators

- › Automatic bricklaying system to prefabricate brick facades
- › 1 m x 2 m façade panels; speed: 5m²/hour due in 2019



Case Study 2

pixelstone[®]



Summary information

<i>Founded in</i>	2015
<i>Location</i>	The Netherlands
<i>Employees</i>	2
<i>Revenue*</i>	\$0

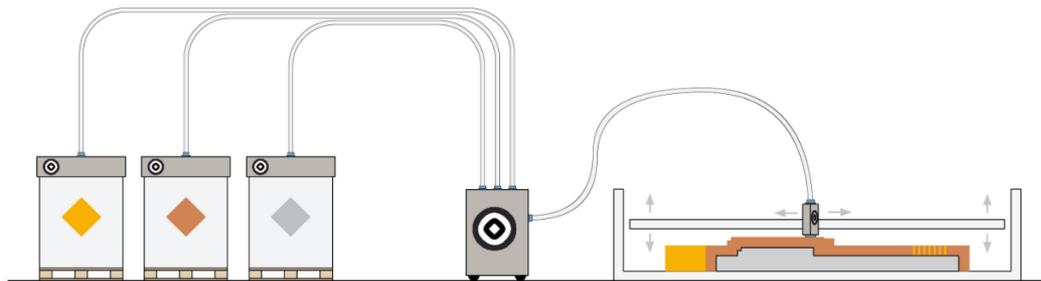
* As of April 2017

Pixelstone

Automated brick façade manufacturing system

› Technology and Differentiators

- › Automatic bricklaying system to prefabricate brick facades
- › 1 m x 2 m façade panels; speed: 5m²/hour due in 2019
- › Uses custom-made small bricks, and proprietary design and manufacturing software



Case Study 2

pixelstone[®]



Summary information

<i>Founded in</i>	2015
<i>Location</i>	The Netherlands
<i>Employees</i>	2
<i>Revenue*</i>	\$0

* As of April 2017

Pixelstone

Automated brick façade manufacturing system

› Strategy and Markets

- › Plans to manufacture and sell façade panels, and to provide custom-designed facades as a service
- › Focuses on the Dutch building market; price estimate: \$200/m²

› Lux Take

- › Brings customization to prefabricated façades space, but needs to standardize products and establish (supply chain and development) partnerships

Case Study 2

pixelstone®



Same material, similar manufacturing methods, but different value propositions



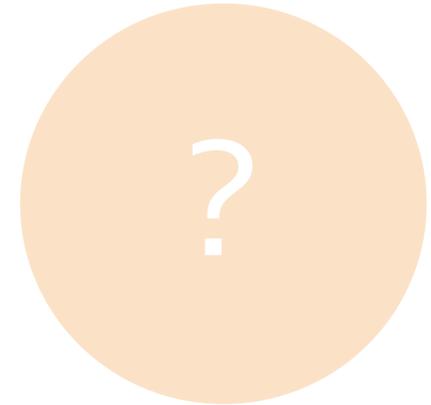
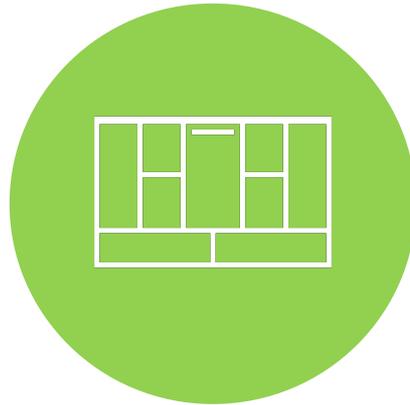
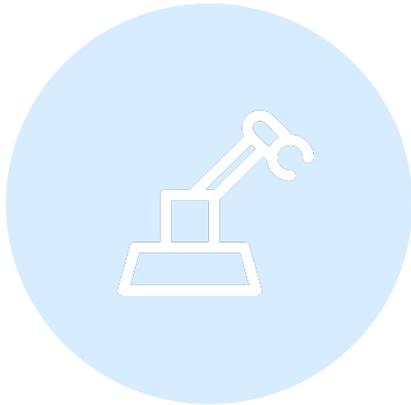
Fastbrick (Hadrian X)	Pixelstone
Walls	Facades
On-site	Off-site
Uses Standard bricks	Uses custom made bricks
Fully automated	Semi-automated
Leasing equipment	Selling products, providing services



Different value chains and partnership opportunities to drive growth

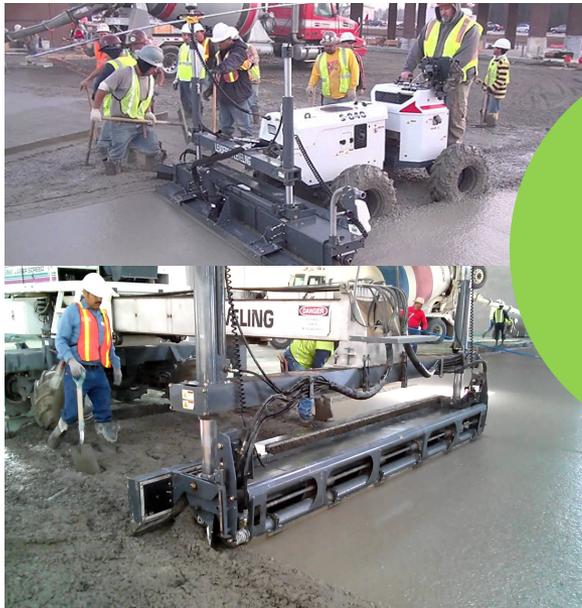
Agenda

- › The 3D robotic bricklaying technologies and business models
- › The effect of these models on value chains
- › Lessons for material commercialization opportunities and key takeaways

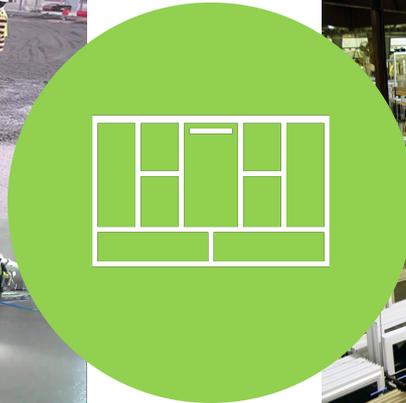


Construction industry is already familiar with equipment leasing and service providing models

- Leasing construction machines (with expert operator)
 - Concrete screed machine



- Selling standard parts customizable per project; service providing
 - Windows

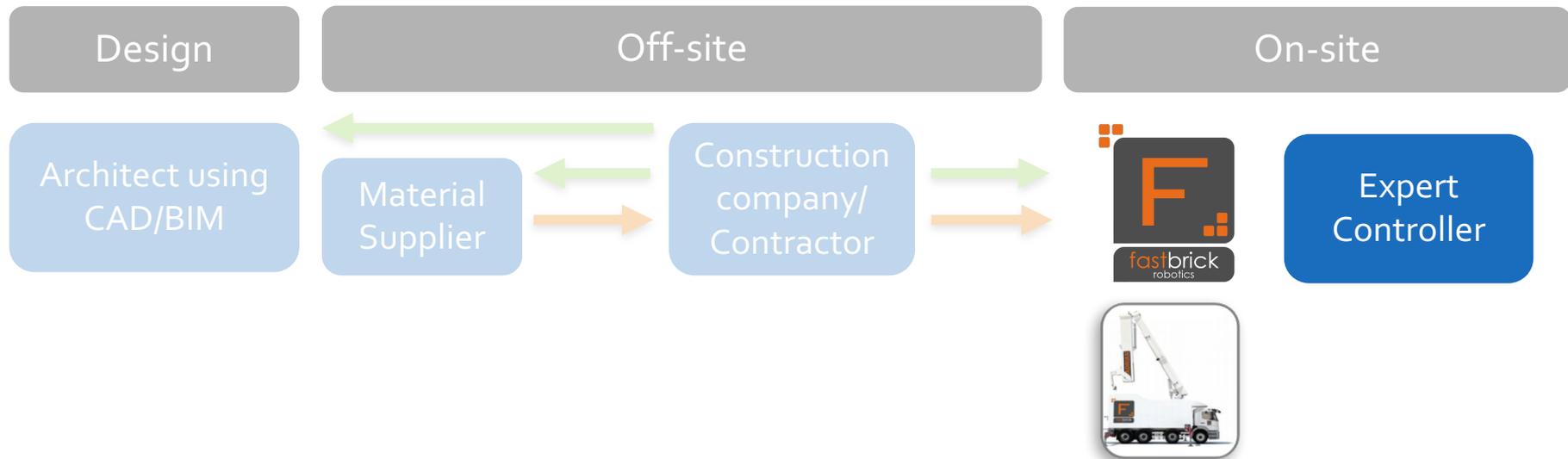


Manual bricklaying value chain



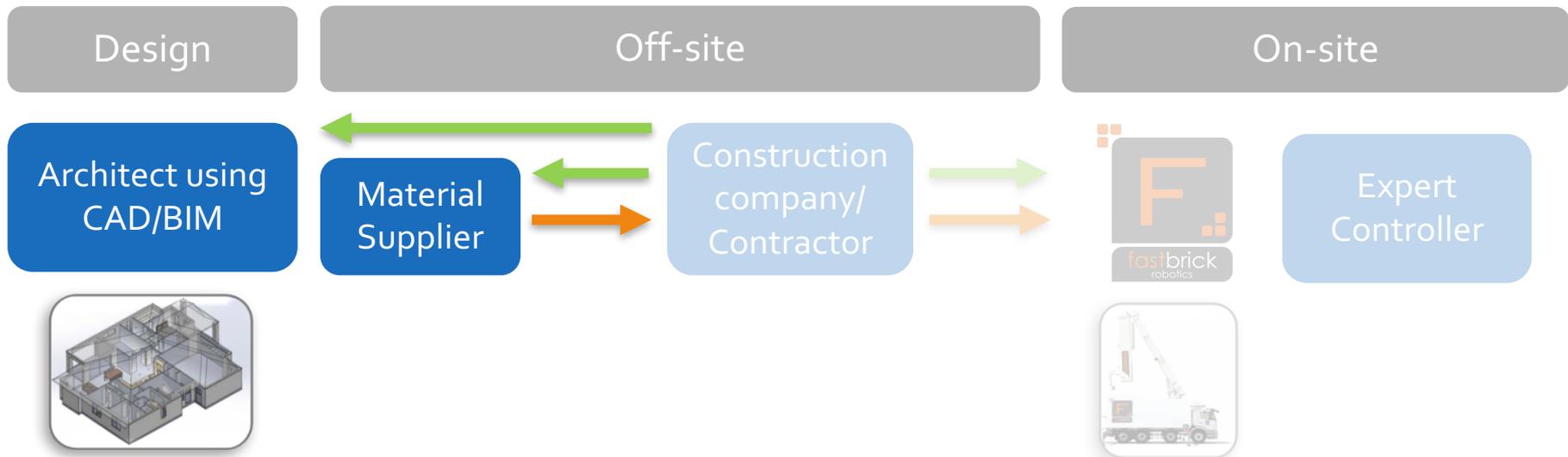
→ Capital flow
→ Material flow

Fastbrick's solution does not require skilled labor but requires expertise in on-site operation



→ Capital flow
→ Material flow

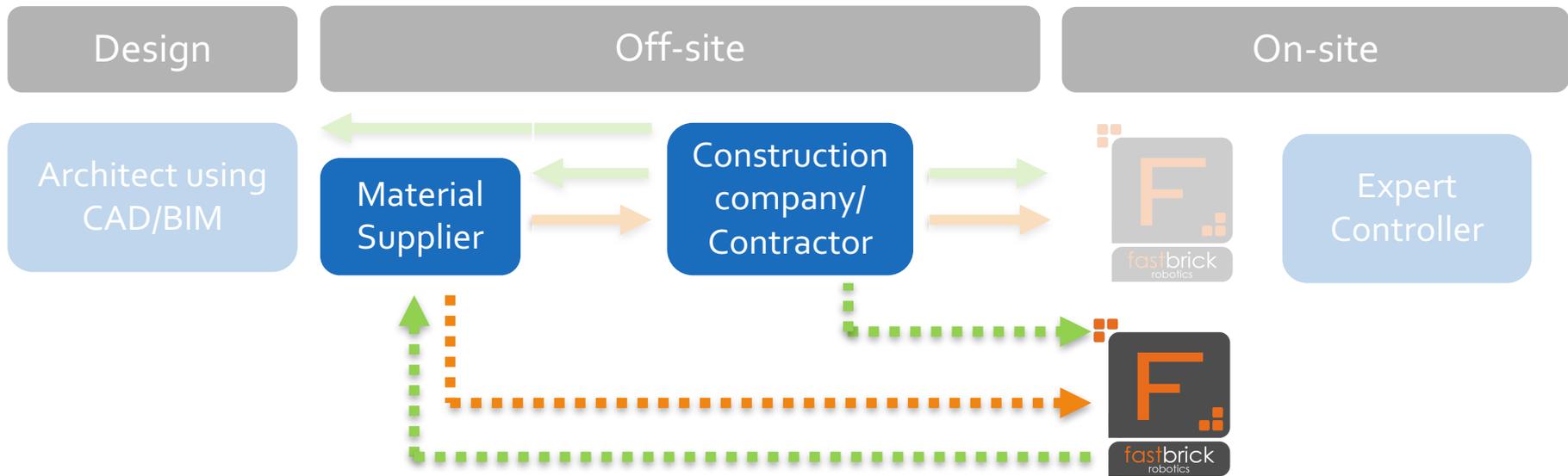
Fastbrick's model brings new marketing and sales opportunities for material suppliers



Digital product data for product marketing

→ Capital flow
→ Material flow

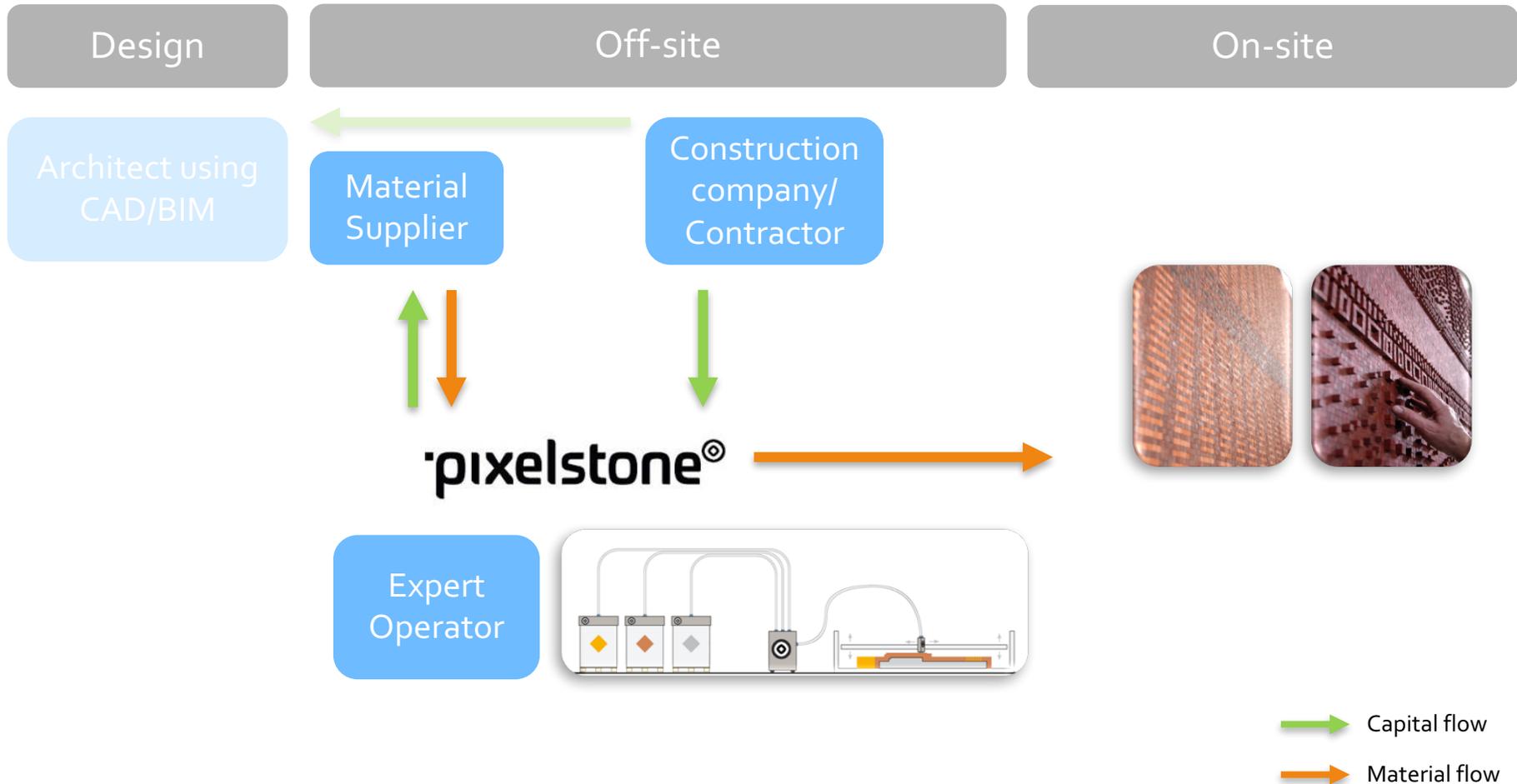
Fastbrick's model brings new marketing and sales opportunities for material suppliers



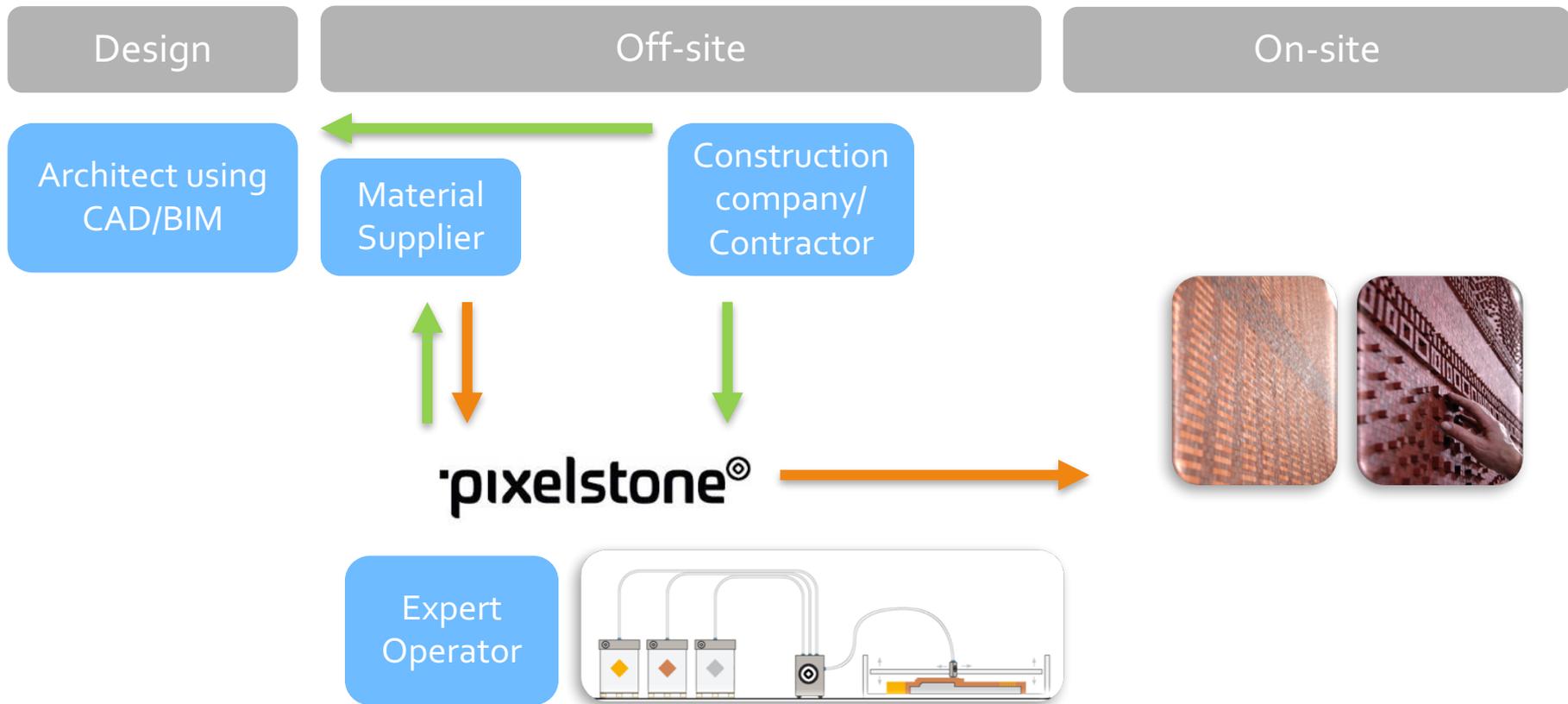
Partnership opportunity for material development and new sales channel

→ Capital flow
→ Material flow

Pixelstone's solution shifts labor from on-site fabrication to off-site operation



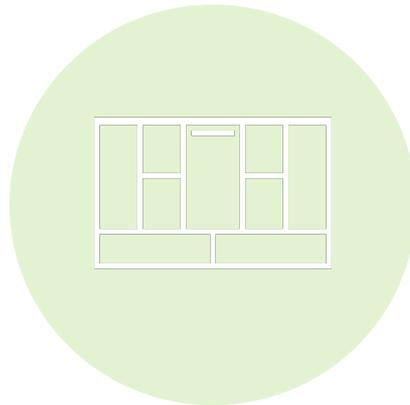
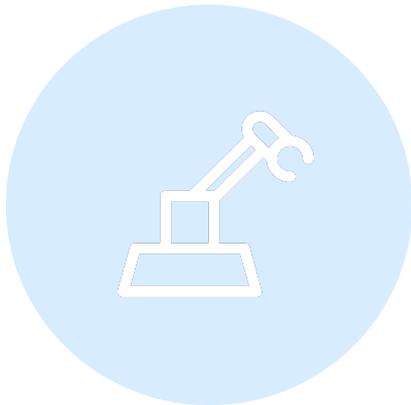
Pixelstone's solution creates opportunities for chemical and materials suppliers



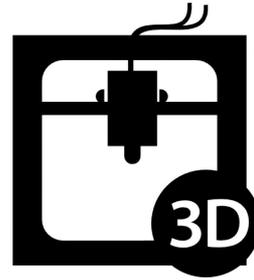
Partnership opportunity for product development
Different sales channel for material suppliers

Agenda

- › The 3D robotic bricklaying technologies and business models
- › The effect of these models on value chains
- › Lessons for material commercialization opportunities and key takeaways



Now, materials processing equipment enables materials suppliers to add value

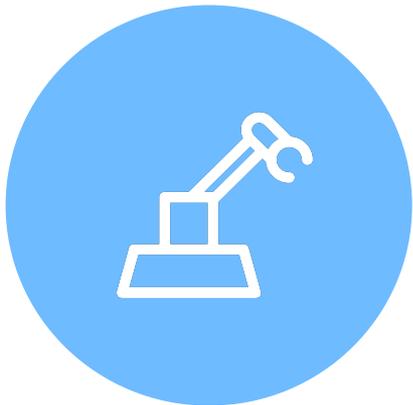


- The variety of 3d printable materials is increasing
- Large C&M firms started to bring their expertise in material science to the 3d printing space



Now, materials processing equipment enables materials suppliers to add value

- Improved product performance and form factors are increasingly important as automation equipment improve
- High performance adhesives, sealants, and material-equipment compatibility are key factors for bricklaying automation to be successful in the long term



Key takeaways

- › Value will shift from labor to materials
 - › Materials have to **fit** the new equipment
- › There will be a shift towards **service providing models**
- › New design and manufacturing tools will create **different marketing and sales channels**
 - › Opportunity to sell to equipment developers and service providers; marketing through digital design tools



Thank you



luxresearch

Tugce Uslu
Research Associate
tugce.uslu@luxresearchinc.com
+31 (0) 20 808 7545